

**Method of production of polysilicate binder for adhesives and coatings,  
polysilicate binder, adhesive composition for adhesives and coatings on its basis**

**FIELD OF INVENTION**

5       The invention relates to the chemical industry, namely production of polysilicate binder, and also adhesive compositions and compositions for protective and decorative coatings production. It can be used in industry and household, namely for adhering ceramic or natural stone tiles or other facing materials to concrete and plastered surfaces of walls, ceilings, floors, for inner and outer finishing of residential and public  
10      buildings, and also for decorative coating and corrosion protection of different surfaces.

**DESCRIPTION OF BACKGROUND ART**

SU 331 080, March 07, 1972 discloses the method of production of silicate binder for adhesive by boiling silicate lump soft at the presence of highly dispersive silicon dioxide (aerosil), which is taken 0.95-2.0 weight portions to 100 weight portions of silicate lump, the process is done under the pressure 2.5-4.0 atmospheres at 120-150 C within 3-16 hours. The present method is one of the methods of production of water glass, which is the basis (binder) for adhesives and coatings.

Water glass produced by this method has a density 1.43-1.45 specific weight (after boiling down), adheres surfaces of wood, ceramic, glass good, but has a low water resistance after curing.

SU 1092939, October 20, 1995 discloses the silicate binder and adhesive composition produced by a step-by-step mixing, of sodium hydroxide, aluminum hydroxide at first, then mixing of the resulting mixture with sodium silicate and kaolin, and addition of a mixture of kizelgur, titanium dioxide at the following ratio of the initial ingredients, in percent by weight:

	Sodium silicate	-19-28
	Aluminum hydroxide	-10-14
	Sodium hydroxide	-7-12
30	Kaolin	-25-29
	Titanium dioxide	-2-5
	Kizelgur	-1-3
	Water	-18-27

The present adhesive binder is mainly used for production of heating elements of high-temperature stoves and high-pressure equipment by addition into it of aluminum oxide, with subsequent drying of formed heating elements at 250 C within 6 hours.

RU 2131447, June 10, 1999 discloses the adhesive composition comprising (in 5 percent by weight) from 38 to 42 sodium silicate solution as a binder, from 34 to 36 marble powder as a filler, 2 sodium sulfide, and the rest is talk. This adhesive composition adheres a wide range of materials such as metal, wood, ceramic tiles, silica glass, linoleum.

This adhesive composition, where water glass is used as a binder, has several 10 considerable drawbacks:

- poor water resistance because of water soluble compounds formed during curing of sodium silicate solution;
- low stability of viscosity and adhesive properties when the composition is stored. The reason is that adhesive composition contains sodium sulfide, which initiates crystallization process under prolonged storage at varying 15 temperatures. Crystallization increases composition viscosity, moreover composition segregates to liquid (water glass) and solid (marble powder) phases. This infringes the reproducibility of adhesive layer strength.

The known prior art discloses the improvement of adhesive and other 20 physicochemical and physicomechanical properties of the silicate binder by varying of addition of different special additives into an adhesive silicate binder during its production and into compositions on its basis.

SU 1422641, January 10, 1996 discloses the composition comprising from 25.0 to 30.0 percent by weight sodium silicate solution of density 1.25-1.28 g/cm<sup>3</sup>, from 0.1 25 to 1.0 percent by weight aerosil, from 0.5 to 1.5 percent by weight carboxymethyl cellylose and from 67.5 to 74.4 percent by weight zinc powder. This composition is used for producing an anticorrosive coating for protection of different metal constructions, and is referred to so-called zinc protective coatings. The composition has a long cure time (within 7 days), the curing start after the applied composition is treated 30 with a curing agent, which is calcium chloride solution.

SU 1773923 A1, November 07, 1992 discloses the improvement of film water-resistance and weather resistance, film is formed from the composition on the basis of silicate binder (water glass) with 2.8 module and specific weight 1.18-1.2 g/cm<sup>3</sup> by introducing into it aluminosilicate, which is perlite and oligomethylhydridesyloxane of

GKZ-94M brand and yellow lead. At the following ration of ingrediants, percent by weight:

Sodium silicate solution	-100.0
Yellow lead	-0.5-1.5
5 Perlite	-80-100
Olygomethylhydridesyloxane	- 2-3

The composition is produced by a step-by-step mixing of components. At first perlite is mixed with lead press, then the mixture is mixed with water glass, and hydrophobic silico-organic liquid GKZ-94M is added. When applied, the composition has a good adhesion to concrete and forms relatively water-resistant coating. But it is not used as adhesive, and its main high physicomechanical properties are obtained due to use of a big amount of perlite (alumosilicate) and silico-organic liquid.

EP 0041212, December 09, 1981 discloses the adhesive composition comprising sodium silicate aqueous solution with weight ratio  $\text{SiO}_2/\text{Na}_2\text{O}$  2.6-3.9:1 and/or 15 potassium silicate aqueous solution with weight ratio  $\text{SiO}_2/\text{K}_2\text{O}$  2-2.6:1 and also 25 to 50 percent by weight finely dispersed (from 1 to 45  $\mu\text{m}$ ) crystallic calcium carbonate originated from metamorphic calcite, 2 to 10 percent by weight quartz powder with the particle size up to 15  $\mu\text{m}$  and developed specific surface area at least  $3.5 \text{ m}^2/\text{g}$ . Also this composition contains up to 24 percent by weight stable aqueous organic polymer dispersion (50% of polymer) such as: acrylate, styrolacrylate, and/or styrolbutadiene. Up to 2 percent by weight lithium hydroxide is added to this adhesive composition in order to improve water resistance.

This adhesive composition is mainly used in industry for adhering mineral fiber tiles and has several considerable drawbacks:

25 - low adhesion strength (about 0.5 to 0.6 MPa);  
- poor activity and properties stability under storage. Calcium carbonate is highly reactive in aqueous solutions of sodium and/or potassium silicates, that leads to thickening and following curing of adhesive composition. All above upsets stability of viscosity and adhesive properties in a short time after 30 composition preparation and thus complicates its use when stored for a long time;  
- adhesion composition components toxicity. It is caused by the fact that organic polymer dispersions (acrylic, styrolic, styrolacrylic, butadienic)

contain residues of monomers (1 to 2%) and synthetic catalysts (0.1%), and also stabilizers (0.5%) and organic solvents (2 to 5%);

- poor thermostability. This is caused by thermal decomposition of calcium carbonate into calcium oxide and carbon dioxide at 300-400°C, that leads to adhesion junction breakdown.

Known adhesive compositions disclosed in US 3721574, August 06, 1968 and RU 2205851, June 10, 2003 don't have many of those drawbacks.

US 3721572, August 06, 1968 discloses the composition for production of adhesive coatings which dry in air and have high water-resistance, chemical resistance, corrosion resistance due to use as a silicate binder a binder consisting of combination of alkali silicate aqueous solution (lithium, sodium or potassium) and colloid silicon dioxide in a form of aqueous dispersion of silicate salt, which is mainly aluminum salt or in a form of metasilicic acid, that provides its certain pH (pH = 10-11) and ratio SiO<sub>2</sub> : Me<sub>2</sub>O in the final binder from 5:1 to 6.5:1. In order to improve necessary properties of the coatings on the basis of this binder, different special additives are added into the composition, for example, polytetrafluoroethylene for chemical resistance, zinc powder in order to obtain corrosion resistant coatings, different organosilanes (bifunctional and trifunctional), such as dimethyldimethoxysylane, arylalcoxysilanes and others, in order to improve hydrophobicity. Alkali silicate with silicate module 3.5-4.0 is used for binder production.

RU 2205851, June 10, 2003 discloses the adhesive composition comprising as a binder a product of interaction between potassium silicate aqueous solution, anhydrous lithium hydroxide mixed with di- or trihydric alcohol or their mixture, vollaonite, talc and inorganic pigment. Initial potassium silicate has density 1.30 – 1.37 g/cm<sup>3</sup> and molar silicate module 3.4-3.7; initial vollaonite has particle size 150 µm and smaller and length to diameter ratio 5-3.1. Components ratio in percent by weight is the following:

	- Above mentioned vollaonite	-38.0-45.0
	- Talc	-8.0-12.0
30	- Anhydrous lithium hydroxide	-1.0-1.5
	- Di- or trihydric alcohol or their mixture	-3.0-5.0
	- Inorganic pigment	- 3.0-5.0
	- Above mentioned potassium silicate solution	- the rest.

So, the silicate binder in this known composition is a complex product of interaction between potassium silicate aqueous solution, anhydrous lithium hydroxide in a mixture with composition components.

The binder and composition are prepared as follows. At the first stage anhydrous lithium hydroxide is added in portions into potassium silicate aqueous solution. Each lithium hydroxide portion is being mixed until its complete dissolution. The product of interaction is ready, and di- or trihydric alcohol or their mixture (for example, ethylene glycol, glycerin) is added in portions into it. A first stage of the product, namely mixture with alcohol, is ready. Then wollastonite and talc are simultaneously added in portions into this mixture and are mixed until getting a homogenous product. At the final stage inorganic pigment is added. Ready-made adhesive composition is bottles and being stored in hermetic packages.

This adhesive composition allows to extend a range of adhered together materials, for example, concrete, ceramics, wood (oak, beech, softwood), marble, steel, glass and their different combinations, where a strong and water-resistant glue joint is formed, but the composition has several considerable drawbacks:

- insufficient strength level (not more than 0.87 MPa of glue joint for some substrates, such as wood, glass, steel, etc.);
- insufficient stability under prolonged storage. That takes place because of fillers sedimentation, which leads to separation into solid and liquid layers.
- low thermal stability. That takes place because organic alcohol used in the binder volatilizes and decomposes at 300-400°C.

### SUMMARY OF THE INVENTION

Object of the present invention is to produce a polysilicate binder, adhesive composition for adhesives and coatings on its basis, providing in combination:

- higher adhesive bond strength under prolonged water exposure for a wider range of substrates, including wood, glass, steel, etc.;
- higher stability under storage;
- ecology safety;
- higher thermal resistance;
- higher refractoriness.

The combination of these properties allows to widen the assortment of the materials to be adhered, and at the same time to save high water-resistance of the glue joint. Also it provides obtaining of coatings (protective and decorative) on different substrates.

5 The goal is achieved owing to the fact that claimed polysilicate binder for adhesives and coatings is produced by interaction while mixing between sodium and/or potassium silicate aqueous solution with silicate module from 2.6 to 3.7 and density from 1.30 to 1.46 g/cm<sup>3</sup> and from 0.5 to 3.0 percent by weight lithium hydroxide on conversion to binder. Then amorphous silicon dioxide with specific surface from 175 to  
10 380 m<sup>2</sup>/g in the amount from 0.2 to 2.0 percent by weight on conversion to binder is added into the product of interaction under higher rate of mixing.

When producing a polysilicate binder, silico-organic compound is added simultaneously with amorphous silicon dioxide at the stage of its addition.

A comparative analysis of the claimed polysilicate binder with the closest  
15 analogues showed that what is unknown is a sequence of stages and their conditions, and mutual use of lithium hydroxide and amorphous silicon dioxide as components of silicate binder on the basis of sodium and/or potassium alkali silicate aqueous solutions.

The necessary condition of obtaining a polysilicate structure of the binder of the three-dimensional structure, a structure consisting of silicon dioxide particles, is the  
20 interaction while mixing the components, and obtaining stabilized with lithium hydroxide a product of its interaction with sodium and/or potassium silicate aqueous solution. Lithium hydroxide dissociates to ions Li<sup>+</sup> and OH<sup>-</sup> in aqueous medium, that leads to shift the equilibrium between polymeric anions towards formation of stable low-temperature forms  $\equiv\text{Si} - \text{O} - \text{Si}\equiv + \text{OH}^- \rightarrow \text{SiOH}^+ \equiv \text{SiO}^-$ .

25 Presence of silanol groups (on the average for each 100A<sup>2</sup> of surface is 3SiOH of the group Aerosil Manufacture, Properties and Applications, Degussa, Frankfurt on Main, West Germany) on the amorphous silicon dioxide surface promotes forming hydrogen bonds of three-dimensional structure between them and groups of stabilized sodium and/or potassium silicate.

30 The other side of the invention is an adhesive composition for production adhesives and coatings, that makes a group of inventions together with the above mentioned method of production a polysilicate binder.

According to invention adhesive composition for adhesives and coatings comprises polysilicate binder produced by one of described methods of invention, inorganic filler, and, if necessary, inorganic pigment, with the following component ratio (in percent by weight):

5	- Polysilicate binder on the basis of sodium and/or potassium silicate, lithium hydroxide and amorphous silicon dioxide	-25-49
	- Inorganic filler	-51-75

10 So, in order to fulfill the claimed group of inventions related to polysilicate binder for adhesives and coatings and method of its production, and adhesive composition used for production adhesives and coatings, sodium or potassium silicate with silicate module ( $\text{SiO}_2$  to  $\text{Me}_2\text{O}$  ratio) from 2.6 to 3.7 and density from 1.30 to 1.46 g/cm<sup>3</sup>, amorphous silicon dioxide with specific surface from 175 to 380 m<sup>2</sup>/g and  
15 lithium hydroxide are used. Silico-organic liquids, which are organosiloxane oligomers and polymers of not high molecular mass ( $2 \cdot 10^2$  -  $2 \cdot 10^5$ ), preferably of linear structure, are used as silico-organic compound when polysilicate binder is produced. The most effective are hydrophobic silico-organic liquids on the liquid basis of brands "Siloksy" (TU-2229-001-23067343-95), "Akvasy" (TU-6-02-1-824-97), and also GSK-1 and  
20 GSK-2 (TU-6405-9501.001-93).

The following is chosen as inorganic fillers:

- passive (in regards to binder) components such as mica, titanium white, cobaltic and cadmic oxidic pigment, feldspar and heavy spar, brickbats. Those components don't send their ions into sodium and/or potassium silicate solution and don't effect the adhesive compositions properties;
- components of lower activity: chalk, marble powder, talk, vollastonite, chromium oxide, manganese dioxide, red iron oxide, aluminum oxide, quartz sand or powder, aluminosilicates;
- active components: zinc oxide, magnesium carbonate, dolomite, broken glass powder, bronze, aluminum and zinc pigments.

30 The choice of concrete fillers and their mass content is made depending on functional, ecological advisability and technological possibilities.

Below there is a description of the essence of the present group of inventions, concrete examples of the inventions realizations and data showing polysilicate binder properties according to the invention, adhesive composition with its use.

The main technological stages of producing polysilicate binder and adhesive compositions on its basis are the following:

Steel or plastic mixture filled with sodium and/or potassium silicate aqueous solution or mixture thereof is loaded in portions with anhydrous or monohydrate (with 1.75 increase of mass ratio) lithium hydroxide, and being mixed until its complete dissolution. After that amorphous silicon dioxide with specific surface from 175 to 380 m<sup>2</sup>/g is added in portions under blades rotating at about 300 RPM. Mass of added silicon dioxide is proportional to its specific surface. After mixing within 30 minutes, polysilicate binder, that is a result of interaction of mentioned components, is ready.

If polysilicate binder comprises additional modifier, silico-organic compound, then it's added simultaneously with mentioned silicon dioxide, and mixed within 30 minutes in a mixture with earlier added components. Polysilicate binder is bottled and being stored in hermetic packages.

In order to produce adhesive compositions on the basis of produced polysilicate binder, a necessary quantity of polysilicate binder is taken, and under mixing inorganic fillers and pigments are added in portions into it. Mixing is being done until getting a homogenous product.

Adhesive composition is bottles and being stored in hermetic packages.

### **PREFERRED EMBODIMENTS OF THE INVENTION**

Example 1. For 1 kg polysilicate binder preparation under room temperature, blade mixer is loaded with 968 g of potassium silicate aqueous solution with the density of 1.30 g/cm<sup>3</sup> and silicate module 3.7 (that is 96.8 percent by weight). Under blades rotating at about 100 RPM, 30 g (3%) of anhydrous lithium hydroxide is added in portions of 5 g. Mixing is being done within about 1 hour until its complete dissolution. After that 2 g (0.2%) of amorphous silicon dioxide with specific surface 380 m<sup>2</sup>/g is added in portions of 0.5 g, and mixing is being done under blades rotating at 300 RPM. After mixing within 30 minutes, polysilicate binder, that is a result of interaction of mentioned in Example components, and is a homogenous viscous-flow mass, is ready.

Example 2. For 1 kg polysilicate binder preparation under room temperature, blade mixer is loaded with 975 g (97.5%) of sodium silicate aqueous solution with the density of 1.46 g/cm<sup>3</sup> and molar silicate module 2.6. Under blades rotating at about 100 RPM, 8.75 g (0.875%) of monohydrate lithium hydroxide (that is 5 g (0.5%), if to calculate onto anhydrous lithium hydroxide) is added in portions. Mixing is being done within about 1 hour until its complete dissolution. After that 20 g (2.0%) of amorphous silicon dioxide with specific surface 175 m<sup>2</sup>/g is added in portions of 4 g, and mixing is being done under blades rotating at 300 RPM. After mixing within 30 minutes, polysilicate binder, that is a result of interaction of mentioned in Example components, 5 and is a homogenous viscous-flow mass, is ready.

Example 3. For 1 kg polysilicate binder preparation under room temperature, blade mixer is loaded with 726 g (72.6%) of potassium silicate aqueous solution with the density of 1.30 g/cm<sup>3</sup> and molar silicate module 3.7, and with 242 g (24.2%) sodium silicate aqueous solution with the density of 1.46 g/cm<sup>3</sup> and molar silicate 15 module 2.6. Ratio of potassium silicate aqueous solution to sodium silicate aqueous solution is 3:1 (75:25). Under blades rotating at about 100 RPM, 12 g (1.2%) of anhydrous lithium hydroxide is added in portions of 5 g. Mixing is being done within about 1 hour until its complete dissolution. After that 20 g (2%) of amorphous silicon dioxide is added, and mixing is being done under blades rotating at 300 RPM within 30 minutes. After that polysilicate binder, that is a result of interaction of mentioned in 20 Example components, and is a homogenous viscous-flow mass, is ready.

Example 4. For 1 kg polysilicate binder preparation under room temperature, blade mixer is loaded with 968 g (96.8%) of potassium silicate aqueous solution with the density of 1.30 g/cm<sup>3</sup> and silicate module 3.7. Under blades rotating at about 100 RPM, 20 g (2%) of anhydrous lithium hydroxide is added in portions of 5 g. Mixing is 25 being done within about 1 hour until its complete dissolution. After that 2 g (0.2%) of amorphous silicon dioxide with specific surface 380 m<sup>2</sup>/g is added in portions of 0.5 g. Simultaneously with amorphous silicon dioxide adding, 10 g (1%) of silico-organic compound, that is a hydrophobic liquid of "Akvasil" brand (TU-6-02-1-824-97) is 30 added in portions of 2.5 g. Polysilicate binder, that is a result of interaction of mentioned in Example components, and is a homogenous viscous-flow mass, is ready.

Polysilicate binders of Examples 5-7 that conform to the applied range of components concentrations and their ratio, and which where chosen according to their

technological effectiveness and special purpose applicability, were produced analogous to technology of producing polysilicate binders described in Examples 1-4.

Glue joint water-resistance was determined by solubility of polysilicate binder, which glued marble samples. Solubility was determined by loss of mass fixed before 5 and after putting the samples into flowing cold water for 5 hours with subsequent drying until constant weight.

Combustibility and combustibility ratio were evaluated according to GOST 12.1.044 and 4.2.1., 4.3. In order to do that, wooden samples were preliminarily prepared by saturation in corresponding polysilicate binder within 1 hour and 10 subsequent drying at 50°C within 8 hours. Glue joint strength was evaluated according to GOST 24064-80 by normal breaking of the adhered samples at the breaking machine of "Instron" type at the rate of clamps moving 100 mm/min.

Example 8. For 1 kg adhesive composition preparation, blade mixer is loaded with 400 g (40.0%) of polysilicate binder produced according to Example 1. Under 15 blades rotating at about 100 RPM the following mineral fillers are added in portions of 100 g: 200 g of talc of MT GSHM brand according to GOST 19284-79 and 400 g (40%) of quartz powder according to TU 5717-001-16767071-95. The mentioned components are mixed within 1 hour until getting a homogenous grey mass.

For Example 8 it's possible to take the following components ratio, in percent by 20 weight:

Talc	- 18-22
Quartz powder	- 38-42
Polysilicate binder according to Example 1	- the rest

Example 11. For 1 kg adhesive composition preparation, blade mixer is loaded 25 with 400 g (40%) of polysilicate binder produced according to Example 2. Under blades rotating at about 100 RPM the following mineral fillers are added: 200 g (20%) of kaolin of KS brand and 400 g (40%) of quartz powder according to TU-5717-001-16767071-95. The mentioned components are mixed within 1 hour until getting a homogenous grey mass.

For Example 9 it's possible to take the components in the following percent by 30 weight:

Kaolin	- 18-22
Quartz powder	- 38-42

Polysilicate binder according to Example 2 - the rest

It's necessary to note that in technological conditions of Examples 8 and 9 modes it's possible to use polysilicate binders according to Examples 3 and 4. Then the adhesive compositions that conform to numbers 10 and 11 of Table 2 are prepared.

5 Example 12. For 1 kg adhesive composition preparation, blade mixer is loaded under room temperature with 420 (42%) of polysilicate binder produced according to Example 1. Under blades rotating at about 100 RPM the following mineral fillers are added in portions: 420 (42%) of wollastonite with particle size 150  $\mu\text{m}$  and with L/D ratio 5-3:1, 120 g (12%) of talc of MT GSHM brand according to GOST 19282-79 and  
 10 40 g (4%) of inorganic rutile pigment, which is titanium dioxide. The mentioned components are mixed within 1 hour until getting a homogenous white mass.

For Example 12, it's possible to take the components in the following percent by weight:

	Vollastonite	- 38-45
15	Talc	- 8-12
	Inorganic pigment, $\text{TiO}_2$	- 3-5
	Polysilicate binder according to Example 1	- the rest

It's necessary to note that in technological conditions of Example 12 modes it's possible to use polysilicate binders according to Examples 2, 3 and 4. Then the  
 20 adhesive compositions that conform to numbers 13, 14 and 15 of Table 2 are prepared.

Example 16. Preparation of polysilicate coatings.

For 1 kg polysilicate facade coating under room temperature, blade mixer is loaded with 250 (25%) of polysilicate binder according to example 1. Under blades rotating at about 100 RPM 650 g (65%) of zinc oxide and 100 g (10%) of diethylene glycol is added in portions. The mentioned components are mixed within 1 hour until getting a homogenous white mass. The prepared polysilicate coating can be used for applying onto plastered buildings facades.

Example 17. Under mixing additionally 10 g (1%) of sodium pentachlorophenate is added into polysilicate coating produced according to formulation and modes of  
 30 Example 16. Prepared polysilicate coating has antibacterial properties in order to protect wooden, concrete products from mold and other bacteria.

Properties of adhesive compositions on the basis of polysilicate binders and their properties are indicated in Table 2.

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While using adhesive composition, it is put on concrete, plastered or other surface in a thin layer (1 to 3 mm) and after that, for example a facing tile is slightly pressed to adhesive composition layer.

Glue joint strength was evaluated according to GOST 24064-80 by normal breaking of the adhered samples at the breaking machine of "Instron" type at the rate of clamps moving 100 mm/min. The samples were fixed to clamps by gluing with epoxy resin with hardener (polyethylene polyamine). Water-resistance of the glue joint was determined as it's described for Examples 1-7.

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Table 1

## Compositions of invented polysilicate binder and their properties

№ of Example	Initial components, percent by weight				
	Potassium silicate aqueous solution, density 1,30g/cm <sup>3</sup> m = 3,7	Sodium silicate aqueous solution, density 1,46g/cm <sup>3</sup> , m = 2,6	Anhydrous lithium hydroxide	Amorphous silicon dioxide	Silico-organic compound
1	96,8	-	3,0	0,2	-
2	-	97,5	0,5	2,0	-
3	72,6	24,2	1,2	2,0	-
4	96,8	-	2,0	0,2	«Akvasil» 1,0
5	96,8	-	3,0	0,2	«Sylotsil» 0,2
6	-	97,5	0,5	2,0	«Akvasil» 2,0
7	72,6	24,2	0,5	1,0	«Sylotsil» 1,7
№ of Example	Properties				
	Glue joint water-resistance in flowing water, 5 hours, percent by weight	*Combustibility and combustibility ratio (K) according to GOST 12.1.044 and 4.2.1., 43	Adhesive bond strength, MPA		
1	0,29	Hardly combustible K = 0,40	0,57	0,70	0,58
2	2,7	Hardly combustible K = 0,46	0,95	0,87	0,78
3	0,89	Hardly combustible K = 0,41	0,71	0,80	0,73
4	0,25	Hardly combustible K = 0,39	0,59	0,68	0,56
5	0,20	Hardly combustible K = 0,31	0,49	0,59	0,51
6	1,8	Hardly combustible K = 0,44	0,78	0,81	0,69
7	0,70	Hardly combustible K = 0,40	0,75	0,80	0,70

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\* Non-treated wood belongs to a class of combustible materials.

Combustible ratio above 2.8.

Table 2

Compositions of adhesives of the basis of polysilicate binders and their properties

№ of Example	Initial components, percent by weight						Polysilicate binder according to Example			
	Talc	Quartz powder	Kaolin	Titanium dioxide	Vollasto- nite		1	2	3	4
	8	20	40	-	-	-	40	-	-	-
9	-	40	20	-	-	-	-	40	-	-
10	18	42	-	-	-	-	-	-	40	-
11	-	42	18	-	-	-	-	-	-	40
12	12	-	-	4	44	40	-	-	-	-
13	10	-	-	5	45	-	40	-	-	-
14	8	-	-	5	38				49	
15	12	-	-	3	45					40
№ of Example	Properties									
	Glue joint water-resistance in flowing water, 5 hours, percent by weight				Adhesive bond strength, MPA					
	Concrete/ ceramics		Concrete/gyp sum fiber		Ceramics/cer amics					
8	0,10			1,87		1,1		2,1		
9	2,8			5,0		Break of gypsum fiber		3,7		
10	0,15			3,5		1,6		2,8		
11	0,05			2,1		1,8		3,1		
12	0,12			1,95		2,0		2,6		
13	2,6			4,8		Break of gypsum fiber		3,9		
14	0,14			3,6		1,76		2,5		
15	0,06			2,0		Break of gypsum fiber		2,3		